29. On the Dental Characters of certain Australian Rats.

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(Text-figures 1–12.)

The observations recorded in the present paper, although very limited in their scope, may possibly prove to be of some value when they are extended over a wider range of types than is available to the author.

The business of diagnosing the specific characters of the material which he studies does not, as a rule, fall within the province of the anatomist, but there are times when even the teacher of human anatomy has to enlarge his field of enquiry, and enlarge it so that he comes within measurable distance of being a systematic zoologist. The attempt to assign a specific name to an Australian Murine is an enterprise no amateur should engage in, and it must not be thought that the present author is responsible for the determination of the species mentioned here. But short of giving an actual name to a species, it may happen that one who is not a systematic zoologist may want to track down, as nearly as possible to its proper position, some animal into the structure of which he is enquiring.

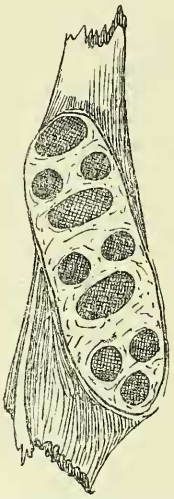
Among the characters which bulk large in the differential diagnosis of various Murines are the crown patterns of the molar teeth. It is quite certain that not a tithe of the literature dealing with the molar patterns of the rats has been reviewed during a search of the works and periodicals available here in Adelaide; but enough has been studied to convince the author that although it is a simple thing to diagnose the crown occlusal pattern of the molars of a young animal, it is difficult or even impossible to say what may have been the pattern when once the molars are worn down in an old or an aged specimen. Text-fig. 8 illustrates the condition of the left upper molar series in three individuals belonging to one species, and it is easy to see that in the oldest individual a diagnosis of the original occlusal pattern is a matter of considerable uncertainty. Consideration of the interesting problem of the relation of crown-pattern to root-formation has prompted the author to turn to the root-patterns in order to see if they presented any constant or useful features.

A series of circumstances has led up to this little investigation of the root-patterns of a few Australian rats. In the first place, a number of skulls and certain cranial fragments were found upon an island,—Franklin Island in Nuyt's Archipelago,—the living rats inhabiting which had been already properly identified. The skulls were all of aged individuals, and no diagnosis could be made from the molar patterns; and yet it was of some importance that the identity of the fragments should be sufficiently well

established to make their relation to the living rats of the island clear.

In the next place, upon another island (Goat Island) in the same Archipelago the tracks of a rat were seen upon the sea-beaches, but despite every effort no rat could be caught or shot or even seen during a brief visit to the island. Nevertheless the fact that the tracks were in reality those of rats was proved by the finding of skull fragments in the dejecta of some birds of prey. These fragments were all of lower jaws and lacked teeth (see text-fig. 1). Save for a single humerus no other portion of the rats was recovered. It was a matter of some interest to see if the rat of Goat Island, and the living rat of Franklin Island, and the dead rat of Franklin Island were or were not identical.

Text-figure 1.



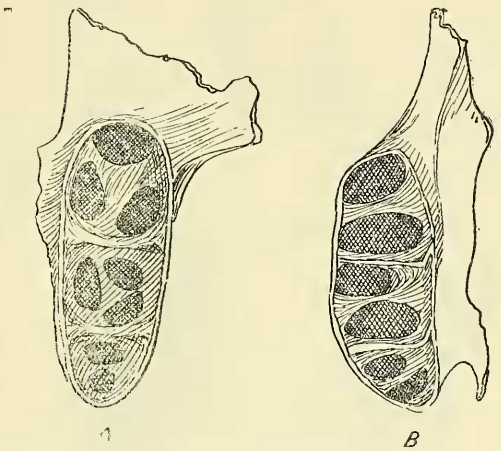
Fragment of left lower jaw taken from the pellets of birds of prey on Goat Island, Nuyt's Archipelago. The edentulous alveolus has a characteristic root-pattern.

Still more recently the author was confronted with the remains of so many rats that the deposit formed by their bones constituted so vast a bulk as to be exploited as a commercial undertaking, though situated some 40 miles from the railroad and some 200 miles from the place to which the deposit could be sent by rail. These bones were in a system of caves (Buckalowie), and among the millions of rats which had gone to the formation of the deposit not one seems to be represented by a whole skull. Jaws and fragments of jaws devoid of teeth were to be had by the thousand (see text-fig. 2), and at once the question arose—Could the fragments be identified by an examination of the jaws from which the teeth had been lost? Whatever the rats were,

they were certainly ancient and they were mixed with the remains of many other animals, amongst which were *Thylacinus* and *Thylacoleo*. Even the accident of the loss of teeth in the jaw fragments composing the deposit on the floor of the caves provided a partial answer to the question, for it was at once evident from an examination of the alveolar cavities for the upper molars that two quite different root-patterns were represented.

In order to determine the affinities of these root-patterns the author extracted teeth from such properly identified skulls as he could obtain, and the present paper is merely a record of the findings. If the results are capable of no further extension, at least they permit one to say that the past and present rats of

Text-figure 2.



Typical fragments from bone débris of Buckalowie Cave deposit. A. Portion bearing left upper molar root-cavities. B. Left lower molar root-cavities.

Franklin Island are the same animal, that the murine contemporary of *Thylacoleo* which formed the cave-deposit at Buckalowie, was a creature a good deal like the Franklin Island rat; but that the unknown rat which lives on Goat Island is not the same sort of rat at all, but is like a rat whose remains make a small and recent addition to the cave-deposits and like existing members of the genus *Rattus*.

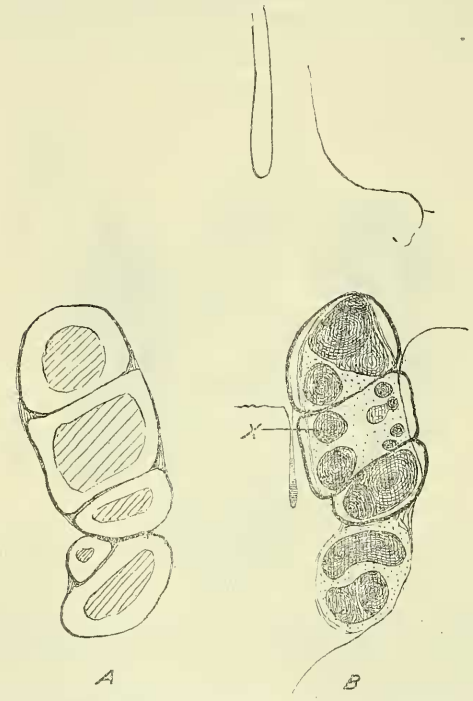
Hydromys Geoff., 1805.

The species examined is that known as the "Golden-bellied Water-Rat," *H. chrysogaster* Geoff. It is now a comparatively rare animal, and in South Australia (and in some of the other States) it is becoming increasingly difficult to obtain. The specimens examined were trapped either on the Onkaparinga River in the Mount Lofty Range or on the River Murray at Tailem Bend. The animal is so thoroughly distinctive that its specific diagnosis needs no authority.

Upper Molars.

The upper molar series when examined from its occlusal surface presents a remarkably simple pattern in the young animal when practically no signs of attrition are present, and the same simplicity is preserved in the adult when attrition is well advanced (see text-fig. 3, A). The anterior molar consists of three very distinct masses arranged in the antero-posterior axis of the tooth.

Text-figure 3.



Left upper molar series of *Hydromys chrysogaster*. A, showing the occlusal surface of the two molars; and B, the alveolar cavities. The outlines of the anterior molar are superimposed on its alveolar cavities in B. The cavity marked × is not present in some specimens.

Each of these divisions shows a central depressed area when viewed from the occlusal surface.

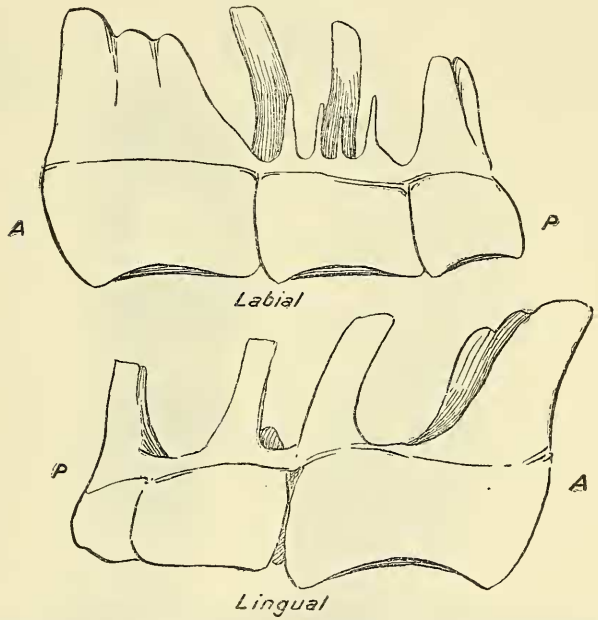
The posterior molar consists of a small anterior lingual portion and a larger posterior mass. The total area of the posterior molar is less than half that of the anterior tooth. (See text-fig. 3.) In advanced age the wear of the tooth involves the raised rim of the individual crown masses, and beyond a flattening of

the occlusal surfaces no marked change of crown-pattern takes place with increasing age.

Upon removing the two upper molars in *Hydromys* a very curious arrangement of the alveolar cavities is seen. There are either 8 or 9 separate sockets for the reception of roots, small or large, of the anterior tooth, and two cavities for the roots of the posterior tooth. (See text-fig. 3, B.)

Of the 8 or 9 root-cavities for the anterior tooth 2 belong to the anterior lamina of the crown, 5 or 6 belong to the middle lamina, and 1 to the posterior lamina.

Text-figure 4.



Anterior left upper molar of *Hydromys chrysogaster* to show the relation of the multiple roots to the crown divisions. In this example only two lingual roots are present. A=anterior, P=posterior extremity of molar.

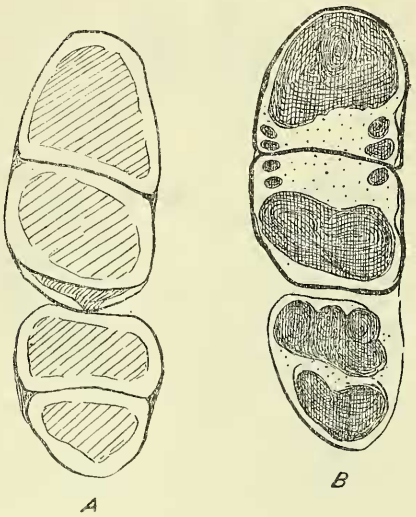
The anterior root is large and shows at its extremity a tendency to be itself subdivided into 3. Four very minute labial cavities belong to four small labial roots of the medial lamina and one or two far larger lingual root-cavities belong to the same subdivision. The small posterior portion of the anterior molar has one large alveolus for a single large root which shows a marked tendency to be bifid. (See text-figs. 3 & 4.)

The two roots of the posterior tooth are arranged in the long axis of the jaw and thus both tend to be elongated from side to side and to be bifid.

Lower Molars.

The lower molar series consists of two dental masses with the same simple type of occlusal surface as that displayed by the upper teeth. The anterior molar is divided into two main parts, and in some specimens, but not in all, a very small posterior shelf is present. The posterior molar is also divided into two main masses, but the whole area of the tooth is considerably less than that of the anterior one. (See text-fig. 5, A.) Again there is the same complexity of the alveolar cavities and roots. Again 9 root-cavities belong to the anterior molar mass. The anterior portion of the anterior molar has a large anterior root and two

Text-figure 5.



Left lower molar series of *Hydromys chrysogaster*. A. Occlusal surface. B. Alveolar cavities, the outlines of the anterior molar being shown.

small postero-lingual and two small postero-labial roots. The posterior portion has two small labial, one small lingual, and a large, transverse, and partially sub-divided posterior root. There are again two rather tortuous root-cavities, situated antero-posteriorly, for the posterior molar. (See text-fig. 5, B.)

Looking at the whole of the peculiar features of this upper and lower molar series, with its strange collection of roots and alveoli, it is difficult to avoid conjecturing that, despite the simple crown-pattern of the anterior molar it is in reality very far from being a simple tooth. It is difficult to avoid speculating as to whether *Hydromys* has in reality simplified its dentition by the loss of a

molar. If the line of the palatal suture, or the origin of the posterior zygoma root, should prove to be at all stable points in cranial architecture, it would look as though the anterior lamina of the upper anterior molar occupied somewhat the same anatomical position as the whole of the anterior molar in more typical forms.

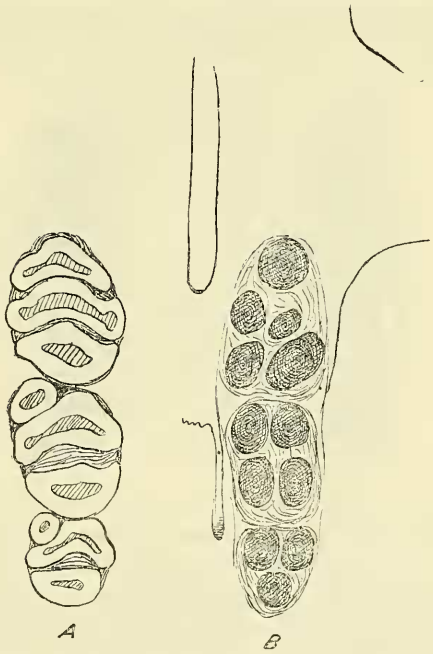
Rattus.

(1) *R. greyi.* Specimens from Mount Compass, South Australia. Identity established by Mr. Oldfield Thomas (Ann. & Mag. Nat. Hist. series 9, vol. viii. p. 425, October 1921).

Upper Molars.

The crown-pattern of the upper molars is shown in text-fig. 6, A.

Text-figure 6.



Left upper molar series of *Rattus greyi*. A, showing the occlusal surface; and B, the alveolar cavities.

It is typical and needs no description.

The roots are small, their alveoli being a series of clean-cut

holes in the jaw-margin, and the tooth itself is not to any extent received in a depressed area of the jaw.

The anterior molar has 5 roots, a large single median anterior root and 4 others arranged in pairs behind it.

The second molar has 4 roots arranged as an anterior pair and a posterior pair. The third molar has an anterior pair of roots arranged labio-lingually and a single median posterior root. In the whole root series there is a single anterior median root, and a single posterior median root, and 5 lingual and 5 labial roots arranged in pairs (see text-fig. 6, B).

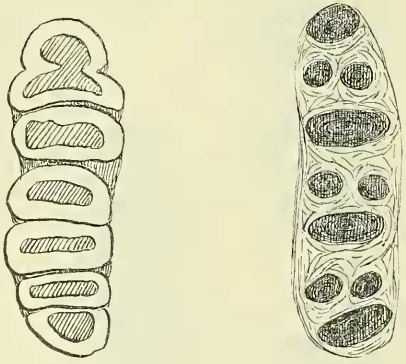
What might be termed the root-formula for the upper molars would therefore be 5. 4. 3.

Lower Molars.

The occlusal surface of the lower molars shows two sub-divisions of the crown of the two posterior molars and three sub-divisions of the anterior molar, the anterior and middle sub-divisions of the anterior tooth being often partially fused together (see text-fig. 7, A).

The root-cavities are well developed and clear cut, like those of the upper molars. The anterior tooth has 4 roots, consisting

Text-figure 7.



Left lower molar series of *Rattus greyi*. A, the occlusal surface; and B, the alveolar cavities.

of an anterior median rounded root followed by a pair of roots (lingual and labial), followed again by a single root elongated from side to side.

The second and third teeth have 3 roots each arranged as a pair of anterior rounded roots and a single elongated posterior root (see text-fig. 7, B). The lower root-formula could therefore be written as 4. 3. 3.

(2) *R. terræ-reginæ* shows exactly the same condition as *R. greyi*

and the introduced forms *R. rattus* and *R. norvegicus* are identical. Evidently the unknown rat which lives on Goat Island is akin, as a comparison of text-figs. 1 & 7, B, will show.

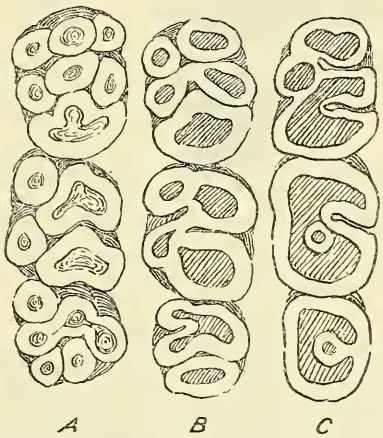
Leporillus Oldfield Thomas, 1906.

The species examined is that recently named *L. jonesi* (Ann. & Mag. Nat. Hist. ser. 9, vol. viii. p. 618, Dec. 1921). All the examples come from Franklin Island in Nuyt's Archipelago, on which island the type was taken.

Upper Molars.

The upper molar occlusal pattern is shown at text-fig. 8. The molars are large and are deep set in the jaws. The alveolar cavities show a rather noteworthy sinking of the whole tooth into the alveolar area of the jaw; the cavities for the individual roots opening from an area which is itself somewhat below the general surface of the surrounding bone. (See text-fig. 9.)

Text-figure 8.



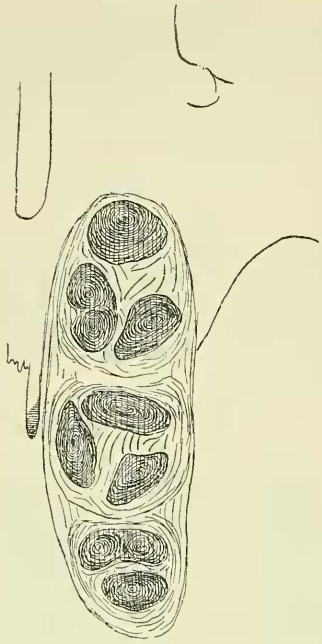
Left upper molar series of *Leporillus jonesi*. Three specimens, A, B, and C, showing the alteration of the occlusal pattern, with varying degrees of attrition.

The first molar has 3 roots, each having a distinct socket in the jaw. Of these three roots one is anterior and median, and the other two are posterior lingual and labial; the postero-lingual root in some specimens shows a tendency to be bifid.

The second molar also has 3 roots, but the lingual root is further advanced in the jaw so as to be more truly lingual, and not so postero-lingual in position.

The third molar has 2 roots, of which the anterior is elongated from side to side and shows a tendency to bifurcation; possibly

Text-figure 9.



Alveolar cavities of the left upper molar series of *Leporillus jonesi*.

it represents the anterior and lingual roots of the second molar. The root formula would therefore be 3. 3. 2.

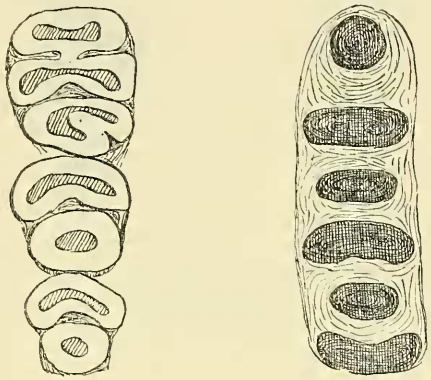
Lower Molars.

Of the lower molars the large anterior member shows three laminæ on its occlusal surface, the second molar two laminæ, and the third also two. The root-pattern shows the same reception of part of the crown into a depressed area of the jaw as is seen in the case of the upper teeth. (See text-fig. 10, B.) Each tooth is provided with 2 roots, and anterior rounded root, and a posterior one elongate from side to side. In the case of the first molar there is a tendency towards lateral bifurcation of the posterior root. The lower root-formula is therefore 2. 2. 2.

The rats whose remains have gone in such countless numbers to constitute the bone-deposits in the Buckalowie caves, had the molars sunk into the jaw in the same fashion as is seen in the Franklin Island *Leporillus*. They had the same root-formula above and below (see text-fig. 2 and compare text-figs. 9 & 10);

they also seem to have had the same crown pattern, certainly they had not the crown pattern which is distinctive of *Conilurus*. The measurements of fragments of their skulls are practically those of the Franklin Island *Leporillus*; and it is probably not far from the truth to say that a rat very like the modern insular

Text-figure 10.



Left lower molar series of *Leporillus jonesi*. A. Occlusal surface. B. Alveolar cavities.

form was a contemporary of *Thylacoleo* and *Thylacinus* in the northern parts of South Australia. No traces of living rats were seen at Buckalowie, nor do the guano-miners know of the presence of any in the district.

Notomys Lesson, 1842.

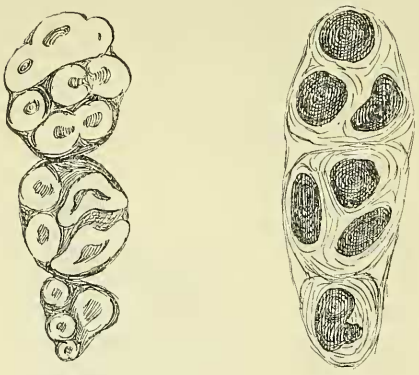
The only example of this genus that I have been able to examine is *N. cervinus*, the specimen coming from Miller's Creek to the west of Lake Eyre.

The specimen is one which shows very little wearing of the occlusal surfaces of the molars. There is seen the same tendency for the tooth to be received in a depression of the jaw as was noted in *Leporillus*. The root-pattern is also reminiscent of that genus, for the upper molars 1 and 2 are 3-rooted teeth, the roots being one anterior and two posterior. The third molar, however (in the only specimen examined), showed a single cavity which contained a partially subdivided root. (See text-fig 11.)

The root-formula would therefore be 3. 3. 1.

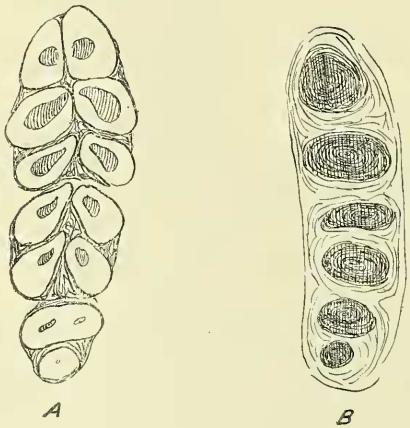
The lower molars are all 2-rooted teeth, but there is a well-marked tendency towards reduction of the posterior root of the third molar. The root-formula is 2. 2. 2.

Text-figure 11.



Left upper molar series of *Notomys cervinus*. A. Occlusal surface. B. Alveolar cavities.

Text-figure 12.



Lower molar series of *Notomys cervinus*. A. Left upper molar crown-pattern. B. Right lower molar root cavities.

Conclusion.—It is suggested that the study of the molar root-pattern, and the expression of what might be termed a root-formula, are of some importance in systematic work among the Murines. Unfortunately it is not possible in Adelaide to carry out even a partial survey of the Australian rodents, for the material is not obtainable, but it is hoped that such workers as possess material will record the root-patterns of *Conilurus*, *Mastacomys*, and other interesting Australian forms.